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Of particular interest is Lucid's use of Object Design's ObjectStore OODBMS. Included in the Energize programming system is a run-time version of ObjectStore OODBMS that functions as the system's DB/Repository.

We recently spoke with the folks at Lucid and discussed their choice of an OODBMS. It seems that during early work on the development environment, the programming team first experimented with a traditional record-and-query-based DB in an attempt to implement persistence with a "home grown" object-based system. However, they quickly became aware that the performance of the file interface was not adequate for the environment's essential requirement — the fast retrieval and update of many small and tightly connected objects. For this reason and others, Lucid decided on an OODBMS implementing a fast navigational object retrieval scheme rather than a query-based scheme. ObjectStore's Object Design fit the bill because it offered Lucid the fast page-based, rather than record-based, implementation of data retrieval and update they desired.

The use of an OODBMS with the Energize Programming System provides two primary benefits. First, it serves as a long-term storage mechanism for all the information about the program under development that is gathered by the various tools. The OODBMS is frequently updated so that if a machine crashes or users simply shut down for the day, they can restart where they left off. In most systems, the programmer has to restart and recreate lost information in order to return to the previous state of the program.

A second benefit of using an OODBMS as opposed to a standard file system or RDBMS is that it allows for very fast access to objects acquired by the tools and passed on to the server. Along with other performance improvements, this provides the user the ability to navigate through very large programs with little or no performance degradation.

Lucid's use of ObjectStore is a good example of a growing trend in which vendors of OO development environments/tools integrate their systems into or alongside OODBMSs (as revealed in Table 1 of our lead article). However, outside of Rational (which has developed its OOA&D Rose on top of Versant), most vendors have up until this time only provided compatibility for their OO environments with OODBMS vendors' products.

Energize is available for SPARCstations and will be ported to other Unix workstation platforms over the next 12 months. The price for a 5-person workgroup version is $16,250; a 10-person workgroup is $29,750. Additional discounts are available.

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## Table 1 — Commercial Object-Oriented Database Management Systems

| OODBMS Products and Vendors | Data Management | | | Storage Management |
|---|---|---|---|---|
| | Implementation Language | DMML | Data Modeling Support for: | Support for: |
| **G-BASE** (version 4.3)<br>Object Databases Inc.<br>228 Broadway<br>Cambridge, MA 02139<br>(617) 354-4220 | C++ | • Language-independent semantic data model<br>• Easily interfaces with C and C++ | • Any language supporting external calls<br>• Any object model through subclasses of metamodel<br>• Multiple inheritance<br>• No multimedia support | • Standard two-phase commit approach for online transaction processing<br>• Access to historical version without locking<br>• Fault tolerance via object request<br>• Supports heterogeneous classes |
| **GemStone**<br>(version 3.0)<br>Servio Corp.<br>14220 Harbor Bay Parkway, Suite 100<br>Alameda, CA 94501<br>(800) 243-9369 | C | • Extended Smalltalk<br>• C<br>• C++<br>• Gemstone visual programming language | • OPAL — extended Smalltalk-like paradigm<br>• Limited schema evolution facilities<br>• All data types are objects<br>• Not strongly typed<br>• Type checking at runtime<br>• No composite objects<br>• No multiple inheritance<br>• Provided Smalltalk and C++ class libraries<br>• Access to relational DBs | • Serialized transactions<br>• Persistent objects<br>• Three locking modes: read, write, and exclusive<br>• No version management<br>• No change notification<br>• Online full and incremental backup<br>• Multi-policy versioning<br>• Optimistic concurrency control |
| **IDB Object DB**<br>(version 1.1)<br>Persistent Data Systems<br>75 West Chapel Ridge Road<br>Pittsburgh, PA 15238<br>(412) 963-1843 | C | • C/IDL schema specification language<br>• Implementations of operations written in C<br>• Data access via API in C | • Multiple inheritance<br>• Dynamic loading/linking of schema and operations<br>• Unique IDs for all objects<br>• ASCII form import/export of all objects | • Nested transactions<br>• Read-only update<br>• Persistent and nonpersistent<br>• Three locking modes: examine, read, write<br>• Transactions serialized<br>• Versioning supports history and parallel alternatives<br>• Storage allocator, garbage collection<br>• No change notification |
| **ITASCA** (version 2.0)<br>Itasca Systems, Inc.<br>7850 Metro Drive<br>Suite 300<br>Minneapolis, MN 55425<br>(612) 851-3155 | C and Common Lisp | • C or Common Lisp<br>• Interfaces for C, C++, and Lisp<br>• Dynamically loads C or Fortran into ITASCA methods<br>• Multiple languages: object created using one language can be used with other languages | • Datatyping optional<br>• Library of utility classes, sites, collections, etc.<br>• Complex, extensive composite objects<br>• Multiple inheritance<br>• Multimedia support<br>• Dynamic schema modification w/out shutting down the DBMS<br>• Refinement of kernel methods on a class basis | • Short, long, and shared transactions<br>• Persistent nested transactions serialized<br>• Elaborate locking on object model<br>• Passive and active change notification<br>• Elaborate/extensible versioning<br>• Application can be converted to multiple DBs at any time<br>• Shared, distributed, and private DBs<br>• Fully distributed with complete location transparency<br>• Methods can be stored in DB as part of schema<br>• Methods execute in DB server allowing multiple language execution |
| **$O_2$** (Version 3.2)<br>$O_2$ Technology<br>7 rue du Parc de Clagny<br>78035 Versailles, France<br>+33 1 30 84 77 77<br>1 Kendall Square<br>Suite 2200<br>Cambridge, MA 02139<br>(617) 621-7041 | C/C++ (2.1) | • C, C++ (2.1) | • Generic collection constructors: set, list (flexible insertable array), bag<br>• Strongly typed<br>• Complex values and objects<br>• Multiple inheritance<br>• Covariance of attributes and methods parameters<br>• Referential integrity<br>• Multiple schemas and DBs<br>• Multimedia support | • Persistent and nonpersistent transactions serialized<br>• Read-only transactions<br>• Two locking modes: read, write<br>• DB administrator mode: no-lock<br>• Index management for collection of complex values<br>• Cluster management<br>• Versioning |

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** July 20-23. **Object World**. San Francisco, California. Sponsored by the Object Management Group. Contact: Object World, c/o World Expo Corp., P.O. Box 9107, Framingham, MA 01701-9107, USA; (800) 225-4698 or (508) 879-6700, Fax: (508) 872-8237. *Will feature seminars and major vendors. Focus will be on object technology as the key to competitive advantage in the 1990s.*

** October 18-22. **OOPSLA '92** (Seventh Annual Conference on Object-Oriented Programming Systems, Languages, and Applications). Vancouver, British Columbia, Canada. Sponsor: ACM. Contact: OOPSLA '92, Tektronix, M/S 47-786, P.O. Box 500, Beaverton, OR 97077, USA; (503) 627-3045.

### 1992 International

March 18-19. **OMG Technical Committee Meeting**. Belfast, Northern Ireland. Contact: Object Management Group, (508) 820-4300, Fax: (508) 820-4303.

March 30-April 2. **TOOLS Europe '92** (Technology of Object-Oriented Systems & Languages). Dortmund, Germany. In USA contact: Burghardt Tendrich, TOOLS Europe '92, 270 Stork Road, Ste. 7, Goleta, CA 93117, USA; (805) 685-1006, Fax: (805) 685-6869. In Europe contact: TOOLS/SQL, 104 rue Castagnary, 75015 Paris, France; +33 1 45 32 58 80, Fax: +33 1 45 32 58 81. *Topics will include: OO analysis and design, management and training issues, experience report, and others.*

May 11-13. **Object Expo**. Munich, Germany. Contact: SIGS Conferences, 588 Broadway, Ste. 604, New York, NY 10012, USA; (212) 274-9135.

June 16-18. **Software Development '92** (The Software Tools Show). Wembley, UK. Contact: Blenheim Online, Blenheim House, Ash Hill Drive, Pinner, Middlesex HA 2AE, UK; + 44 81 868 4466, Fax: +44 81 866 5691.

June 29-July 3. **ECOOP '92**. Utrecht, The Netherlands. Sponsors include the Software Engineering research Center, DND, George Heeg Smalltalk-80-Systems, Austrian Computer Society, Swiss Computer Society, and the Object Management Group. Contact: Gert Florijn, Software Engineering Research Center, P.O. Box 424, 3500 AK Utrecht, The Netherlands; +31 30 322640, Fax: +31 30 341249.

October 28-30. **Third Eurographics Workshop On Object-Oriented Graphics**. Champery, Switzerland. Sponsored by the Universite de Geneve, Centre Universitaire d'Informatique. Contact: Eurographics Workshop on Object-Oriented Graphics, Centre Universitaire d'Informatique, 12 rue du Lac, CH-1207 Geneva, Switzerland; +41 22 787 65 86, Fax: +41 22 735 39 05.

** Dec 7-11. **Toulouse '92** (Fifth International Conference on Software Engineering & Its Applications). Sponsored by Cigref, SEE, and Syntec-Informatique. Contact: EC2, 269 rue de La Garenne, 92024 Nanterre Cedex, France; +331 4780 7000, Fax: +331 4780 6629.

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**Editorial Office:** ***Object-Oriented Strategies***, 151 Collingwood, San Francisco, CA 94114, USA; (415) 861-1660, Fax: (415) 861-5398.

**Circulation Office:** ***Object-Oriented Strategies*** is published monthly by Cutter Information Corp., 37 Broadway, Arlington, MA 02174-5539, USA; (617) 648-8700, Fax: (617) 648-8707, Telex: 650 100 9891.

**Subscriptions:** $495 per year, $565 outside North America. ISSN 1059-4108.

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